EXPERIMENT 2: LINEAR MOTION – constant speed – the best fit line

PURPOSE:
Analyze and describe motion with a constant velocity

MATERIALS:
toy rover (from arbor for example Product # 44-1090), time watch, tape

APPLET:
http://www.walter-fendt.de/html5/phen/acceleration_en.htm

DATE_____

AUTHOR_____

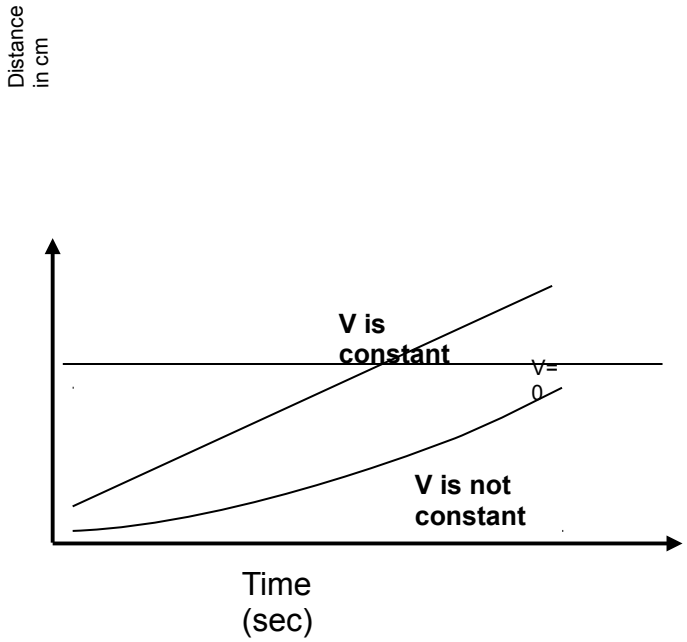
PARTNER_____

PARTNER_____

BACKGROUND

In this lab, you will analyze and describe motion with a constant velocity. Motion with a constant velocity will be investigated by using a battery-operated bulldozer that moves at a constant speed. Data will be collected, analyzed, and a concept will be formalized to describe what is happening to the car as it move.

Figure below compare the distance versus time for motion with a constant velocity, with a non constant velocity,and with no velocity at all.
Can you tell which one is which ?



Note that the slope for some object not moving will be a straight line. If a vehicle is moving at a uniform (constant) velocity the line will have a positive slope. This slope will describe the magnitude of the velocity, sometimes referred as the speed. The line for a vehicle moving at a non constant speed is also known as accelerated motion, on the other hand, will be non constant. A non constant speed is also known as an accelerated motion, and the ratio of how fast the motion is changing per unit of time is called acceleration.

Taking measurable data from a multitude of sense impressions, finding order in the data, then inventing a concept to describe the order are the activities of science. This investigation applies this process to motion.

PROCEDURE

PART A: Constant speed. Finding the speed using the best fit line.

1. To mark the distances you will use the tiles covering the floor. The unit for distance i**s one tile**. The unit for time is second. Therefore the unit for speed is tiles/seconds or tiles per second or tiles/s for short. If you get a speed of 5 tiles/s than means the car covers 5 tiles every second.
2. Mark a starting line with a ruler or tape. One student in the group has a sop watch and computes the **time for the car to cover 2 tiles**. It is a team work so divide the tasks among the students. Record the data in the table below.
3. Place the car back to the starting line and compute the times it takes the car to cover 4 tiles. Record in the table below..
4. Repeat for 6 tiles, 8 tiles… Each time the car is placed back to the starting line.

5. Make a scatter plot (use plot.ly on line). **Distance is on the y-axis and Time is on the x-axis.** You are plotting *distance versus time*. The graph describe the motion of the car.

6. If you have a spreadsheet program (like excel or LibreOffice or plot.ly) use the spreadsheet to trace the best fit line and to compute the equation of the best fit line. (select insert trend line and display equation). Report the equation here :

   y = ___x (your y-intercept should be zero)

table

Time (s)	Distance (tiles)
0	0
	2
	4
	6
	8
	10

ANALYSIS

1. The slope of the line is ____ tiles /s. It represents the _____ of the car. It means that in 1 second, the car covers _____ tiles.

   The equation of the line is : y = ____ x

   with y representing the _____ and x the _____

2. For motion with a constant velocity, the distance covered every second:

   A) increases B) stays the same C) decreases D) not enough information

3. Let's investigate a motion with an acceleration. Run the applet (see front page for the link). The car has no initial speed but has an acceleration of 1m/s/s. Run the application.

   Observe the ***graph distance versus time*** (x versus t).

   A) Do you still get a line ?

   B) Draw below right what the graph distance versus time looks like in this case.

   C) What this graph called?

   D) Observe the graph v versus t (speed versus time). Is it a line ?

If yes. Compute the slope. Slope = _____ m/s (rise/run)

Why is it consistent with the acceleration ? Why ?

4. For an uniformly accelerated motion (Q3). The distance covered per unit time:

A) stays the same B) increases with time C) decreases with time D) not enough information

5. Now change the initial conditions of the applet to the following: initial position=10m

initial velocity = 5m/s acceleration = 0

run the application. Draw the graph x vs t below (***distance vs tim***e).

The line does not go through the origin anymore. The y-intercept is ____. What does it represent ?

CONCLUSION:

Was the purpose of this lab accomplished ? Why or Why not ?

(your answer to this question should show thoughtful analysis and careful, through thinking)